

1 **CLAIMS**

2 **1.** In a distributed computing environment, a method for dynamically
3 implementing workflow responsive to a directory object state change, the method
4 comprising:

5 detecting a state change to an object in a directory; and

6 responsive to detecting the state change:

7 mapping the state change to the object to a workflow comprising a
8 set of tasks; and

9 executing the tasks to achieve a desired state in the directory.

10
11 **2.** A method as recited in claim 1, wherein executing the tasks further
12 comprises storing the desired state.

13
14 **3.** A method as recited in claim 1, wherein executing the tasks further
15 comprises continuously executing an operation of a task of the tasks until
16 convergence of the desired state is identified.

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18 **4.** A method as recited in claim 1, wherein executing the tasks further
19 comprises storing a sequence of operations based on the tasks.

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21 **5.** A method as recited in claim 1, wherein executing the tasks further
22 comprises storing information corresponding to one or more directory objects to
23 which the workflow applies.
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1 **6.** A method as recited in claim 1, wherein executing the tasks further
2 comprises storing status information based on respective status of at least one
3 subset of the tasks.

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5 **7.** A method as recited in claim 1, wherein mapping the state change to
6 the object further comprises evaluating the state change to the object based on a
7 declarative condition stored as a text string on an object instance of a content class
8 defined by the directory schema.

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10 **8.** A method as recited in claim 1, wherein a task of the tasks comprises
11 any combination of a declarative condition or an operation that is stored as a text
12 string on an object instance of a content class defined by the directory schema.

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14 **9.** A method as recited in claim 1, wherein semantics of the workflow
15 are based on a workflow schema.

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17 **10.** A method as recited in claim 1, wherein mapping the state change to
18 the object, semantics of the mapping are based on an event association object
19 schema.

1 **11.** A method as recited in claim 1, wherein executing the tasks at least
2 one subset of the tasks are executed with respect to one another based on an order
3 of execution relationship comprising a finish-start relationship, a parallel
4 execution relationship, a precedence constraint relationship, or a task priority
5 relationship.

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7 **12.** A method as recited in claim 1, wherein executing the tasks at least
8 one subset of the tasks is executed with respect to one another based on a
9 precedence constraint relationship or a task priority relationship.

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11 **13.** A method as recited in claim 1, wherein the method further
12 comprises:

13 monitoring a status corresponding to a task of the tasks;
14 storing the status on a status monitoring object; and
15 wherein a content class in the directory schema defines the status-
16 monitoring object.

17
18 **14.** A method as recited in claim 1, wherein the method further
19 comprises:

20 monitoring a set of directory resources affected by the workflow;
21 storing the directory resources on a status monitoring object; and
22 wherein a content class in the directory schema defines the status-
23 monitoring object.

1 **15.** A method as recited in claim 1, wherein the method further
2 comprises:

3 monitoring a status corresponding to an operation of the workflow;
4 determining that the status comprises a failure status;
5 responsive to the determining, taking a corrective action to advance the
6 workflow in view of the failure status; and

7 wherein a content class in the directory schema defines the status-
8 monitoring object.

9
10 **16.** A method as recited in claim 1, wherein executing the tasks further
11 comprises:

12 updating a status corresponding to a task in the workflow; and
13 responsive to the updating, evaluating the workflow to determine that a
14 next task of the tasks to be implemented.

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16 **17.** A method as recited in claim 1, wherein the tasks represent an
17 inverse set of tasks that were previously performed as part of a different workflow.

18
19 **18.** A method as recited in claim 1, wherein the tasks implement a
20 policy with respect to one or more directory resources, and wherein mapping the
21 state change to the object further comprises automatically determining the
22 workflow based on the policy.

1 **19.** A computer-readable medium comprising computer-executable
2 instructions for dynamically implementing workflow responsive to a directory
3 object state change, the computer-executable instructions comprising instructions
4 for:

5 detecting a state change to an object in a directory; and

6 responsive to detecting the state change:

7 mapping the state change to the object to a workflow comprising a
8 set of tasks; and

9 executing the tasks to achieve a desired state in the directory.

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11 **20.** A computer-readable medium as recited in claim 19, wherein the
12 instructions for executing the tasks further comprise instructions for storing the
13 desired state.

14
15 **21.** A computer-readable medium as recited in claim 19, wherein the
16 instructions for executing the tasks further comprise instructions for continuously
17 executing an operation of a task of the tasks until convergence of the desired state
18 is identified.

19
20 **22.** A computer-readable medium as recited in claim 19, wherein the
21 instructions for executing the tasks further comprise instructions for storing a
22 sequence of operations based on the tasks.

1 **23.** A computer-readable medium as recited in claim 19, wherein
2 instructions for executing the tasks further comprise instructions for storing
3 information corresponding to one or more directory objects to which the workflow
4 applies.

5
6 **24.** A computer-readable medium as recited in claim 19, wherein the
7 instructions for executing the tasks further comprise instructions for storing status
8 information based on respective status of at least one subset of the tasks.

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10 **25.** A computer-readable medium as recited in claim 19, wherein the
11 instructions for mapping the state change to the object further comprise
12 instructions for evaluating the state change to the object based on a declarative
13 condition stored as a text string on an object instance of a content class defined by
14 the directory schema.

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16 **26.** A computer-readable medium as recited in claim 19, wherein a task
17 of the tasks comprises any combination of declarative conditions and operations
18 that are stored as a text string on an object instance of a content class defined by
19 the directory schema.

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21 **27.** A computer-readable medium as recited in claim 19, wherein
22 semantics of the workflow are based on a workflow schema.
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1 **28.** A computer-readable medium as recited in claim 19, wherein the
2 instructions for mapping the state change to the object, semantics of the mapping
3 are based on an event association object schema.

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5 **29.** A computer-readable medium as recited in claim 19, wherein the
6 instructions for executing the tasks, at least one subset of the tasks are executed
7 with respect to one another based on an order of execution relationship comprising
8 a finish-start relationship, a parallel execution relationship, a precedence constraint
9 relationship, or a task priority relationship.

10
11 **30.** A computer-readable medium as recited in claim 19, wherein the
12 instructions for executing the tasks, at least one subset of the tasks are executed
13 with respect to one another based on a precedence constraint relationship or a task
14 priority relationship.

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16 **31.** A computer-readable medium as recited in claim 19, wherein the
17 computer-executable instructions further comprise instructions for:

18 monitoring a status corresponding to a task of the tasks;
19 storing the status on a status monitoring object; and
20 wherein a content class in the directory schema defines the status-
21 monitoring object.

22
23 **32.** A computer-readable medium as recited in claim 19, wherein the
24 computer-executable instructions further comprise instructions for:

25 monitoring a set of directory resources affected by the workflow;

1 storing the directory resources on a status monitoring object; and
2 wherein a content class in the directory schema defines the status-
3 monitoring object.
4

5 **33.** A computer-readable medium as recited in claim 19, wherein the
6 computer-executable instructions further comprises instructions for:

7 monitoring a status corresponding to an operation of the workflow;
8 determining that the status comprises a failure status;
9 responsive to the determining, taking a corrective action to advance the
10 workflow in view of the failure status; and

11 wherein a content class in the directory schema defines the status-
12 monitoring object.
13

14 **34.** A computer-readable medium as recited in claim 19, wherein the
15 instructions for executing the tasks further comprise instructions for:

16 updating a status corresponding to a task in the workflow; and
17 responsive to the updating, evaluating the workflow to determine that a
18 next task of the tasks to be implemented.
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20 **35.** A computer-readable medium as recited in claim 19, wherein the
21 tasks represent an inverse set of tasks that were previously performed as part of a
22 different workflow.
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1 **36.** A computer-readable medium as recited in claim 19, wherein the
2 tasks implement a policy with respect to one or more directory resources, and
3 wherein the instructions for mapping the state change to the object further
4 comprises instructions for automatically determining the workflow based on the
5 policy.

6
7 **37.** A computing device comprising:
8 a memory comprising computer-executable instructions for dynamically
9 implementing workflow responsive to a directory object state change; and
10 a processor coupled to the memory for executing the computer-executable
11 instructions, the computer-executable instructions comprising instructions for:
12 detecting a state change to an object in a directory; and
13 responsive to detecting the state change:
14 mapping the state change to the object to a workflow
15 comprising a set of tasks; and
16 executing the tasks to achieve a desired state in the directory.

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18 **38.** A computing device as recited in claim 37, wherein the instructions
19 for executing the tasks further comprise instructions for storing the desired state.

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21 **39.** A computing device as recited in claim 37, wherein the instructions
22 for executing the tasks further comprise instructions for continuously executing an
23 operation of a task of the tasks until convergence of the desired state is identified.
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1 **40.** A computing device as recited in claim 37, wherein the instructions
2 for executing the tasks further comprise instructions for storing a sequence of
3 operations based on the tasks.

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5 **41.** A computing device as recited in claim 37, wherein instructions for
6 executing the tasks further comprise instructions for storing information
7 corresponding to one or more directory objects to which the workflow applies.

8
9 **42.** A computing device as recited in claim 37, wherein the instructions
10 for executing the tasks further comprise instructions for storing status information
11 based on respective status of at least one subset of the tasks.

12
13 **43.** A computing device as recited in claim 37, wherein the instructions
14 for mapping the state change to the object further comprise instructions for
15 evaluating the state change to the object based on a declarative condition stored as
16 a text string on an object instance of a content class defined by the directory
17 schema.

18
19 **44.** A computing device as recited in claim 37, wherein a task of the
20 tasks comprises any combination of one or more declarative conditions and one or
21 more operations represented by a text string stored on an object instance of a
22 content class defined by the directory schema.

1 **45.** A computing device as recited in claim 37, wherein semantics of the
2 workflow are based on a workflow schema.

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4 **46.** A computing device as recited in claim 37, wherein the instructions
5 for mapping the state change to the object, semantics of the mapping are based on
6 an event association object schema.

7
8 **47.** A computing device as recited in claim 37, wherein the instructions
9 for executing the tasks, at least one subset of the tasks are executed with respect to
10 one another based on an order of execution relationship comprising a finish-start
11 relationship, a parallel execution relationship, a precedence constraint relationship,
12 or a task priority relationship.

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14 **48.** A computing device as recited in claim 37, wherein the instructions
15 for executing the tasks, at least one subset of the tasks are executed with respect to
16 one another based on a precedence constraint relationship or a task priority
17 relationship.

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19 **49.** A computing device as recited in claim 37, wherein the computer-
20 executable instructions further comprise instructions for:
21 monitoring a status corresponding to a task of the tasks;
22 storing the status on a status monitoring object; and
23 wherein a content class in the directory schema defines the status-
24 monitoring object.
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1 **50.** A computing device as recited in claim 37, wherein the computer-
2 executable instructions further comprise instructions for:
3 monitoring a set of directory resources affected by the workflow;
4 storing the directory resources on a status monitoring object; and
5 wherein a content class in the directory schema defines the status-
6 monitoring object.

7
8 **51.** A computing device as recited in claim 37, wherein the computer-
9 executable instructions further comprises instructions for:
10 monitoring a status corresponding to an operation of the workflow;
11 determining that the status comprises a failure status;
12 responsive to the determining, taking a corrective action to advance the
13 workflow in view of the failure status; and
14 wherein a content class in the directory schema defines the status-
15 monitoring object.

16
17 **52.** A computing device as recited in claim 37, wherein the instructions
18 for executing the tasks further comprise instructions for:
19 updating a status corresponding to a task in the workflow; and
20 responsive to the updating, evaluating the workflow to determine that a
21 next task of the tasks to be implemented.

1 **53.** A computing device as recited in claim 37, wherein the tasks
2 represent an inverse set of tasks that were previously performed as part of a
3 different workflow.

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5 **54.** A computing device as recited in claim 37, wherein the tasks
6 implement a policy with respect to one or more directory resources, and wherein
7 the instructions for mapping the state change to the object further comprises
8 instructions for automatically determining the workflow based on the policy.

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10 **55.** A computing device comprising processing means for:
11 detecting a state change to an object in a directory; and
12 responsive to detecting the state change:
13 mapping the state change to the object to a workflow comprising a set of
14 tasks; and
15 executing the tasks to achieve a desired state in the directory.

16
17 **56.** A computing device as recited in claim 55, wherein the means for
18 executing the tasks further comprise means for storing the desired state.

19
20 **57.** A computing device as recited in claim 55, wherein the means for
21 executing the tasks further comprise means for continuously executing an
22 operation of a task of the tasks until convergence of the desired state is identified.
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1 **58.** A computing device as recited in claim 55, wherein the means for
2 executing the tasks further comprise means for storing a sequence of operations
3 based on the tasks.

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5 **59.** A computing device as recited in claim 55, wherein means for
6 executing the tasks further comprise means for storing information corresponding
7 to one or more directory objects to which the workflow applies.

8
9 **60.** A computing device as recited in claim 55, wherein the means for
10 executing the tasks further comprise means for storing status information based on
11 respective status of at least one subset of the tasks.

12
13 **61.** A computing device as recited in claim 55, wherein the means for
14 mapping the state change to the object further comprise means for evaluating the
15 state change to the object based on a declarative condition stored as a text string
16 on an object instance of a content class defined by the directory schema.

17
18 **62.** A computing device as recited in claim 55, wherein a task of the
19 tasks comprises any combination of one or more declarative conditions and one or
20 more operations represented by a text string stored on an object instance of a
21 content class defined by the directory schema.

22
23 **63.** A computing device as recited in claim 55, wherein semantics of the
24 workflow are based on a workflow schema.

1 **64.** A computing device as recited in claim 55, wherein the means for
2 mapping the state change to the object, semantics of the mapping are based on an
3 event association object schema.

4
5 **65.** A computing device as recited in claim 55, wherein the means for
6 executing the tasks, at least one subset of the tasks are executed with respect to
7 one another based on an order of execution relationship comprising a finish-start
8 relationship, a parallel execution relationship, a precedence constraint relationship,
9 or a task priority relationship.

10
11 **66.** A computing device as recited in claim 55, wherein the means for
12 executing the tasks, at least one subset of the tasks are executed with respect to
13 one another based on a precedence constraint relationship or a task priority
14 relationship.

15
16 **67.** A computing device as recited in claim 55, further comprising
17 processing means for:

18 monitoring a status corresponding to a task of the tasks;

19 storing the status on a status monitoring object; and

20 wherein a content class in the directory schema defines the status-
21 monitoring object.

1 **68.** A computing device as recited in claim 55, further comprising
2 processing means for:

3 monitoring a set of directory resources affected by the workflow;

4 storing the directory resources on a status monitoring object; and

5 wherein a content class in the directory schema defines the status-
6 monitoring object.

7
8 **69.** A computing device as recited in claim 55, further comprising
9 processing means for:

10 monitoring a status corresponding to an operation of the workflow;

11 determining that the status comprises a failure status;

12 responsive to the determining, taking a corrective action to advance the
13 workflow in view of the failure status; and

14 wherein a content class in the directory schema defines the status-
15 monitoring object.

16
17 **70.** A computing device as recited in claim 55, wherein the means for
18 executing the tasks further comprise means for:

19 updating a status corresponding to a task in the workflow; and

20 responsive to the updating, evaluating the workflow to determine that a
21 next task of the tasks to be implemented.

1 71. A computing device as recited in claim 55, wherein the tasks
2 represent an inverse set of tasks that were previously performed as part of a
3 different workflow.

4
5 72. A computing device as recited in claim 55, wherein the tasks
6 implement a policy with respect to one or more directory resources, and wherein
7 the means for mapping the state change to the object further comprise means for
8 automatically determining the workflow based on the policy.

9
10 73. A workflow enabled directory schema comprising a plurality of base
11 object content classes, the workflow enabled directory schema:

12 a provisioning service content class to detect an event corresponding to a
13 state change in a directory object;

14 a workflow content class for storing a sequence of tasks; ;

15 an event association content class for storing declarative conditions to map
16 the state change to the directory object to an object instance of the workflow
17 content class; and

18 wherein the provisioning service content class is further configured to
19 execute the sequence of tasks corresponding to the object instance.

1 74. A workflow enabled directory schema as recited in claim 73,
2 wherein at least a subset of the base object content classes comprise a respective
3 flexible attribute data field that indicates a data type, the data type being used to
4 express various operational or data providing properties of the flexible attribute,
5 the various operational or data providing properties being independent of the data
6 type and independent of any modification to the workflow enabled directory
7 schema.

8
9 75. A workflow enabled directory schema as recited in claim 73,
10 wherein the sequence of tasks comprises any combination of a declarative
11 conditions and operations corresponding to directory-based objects.

12
13 76. A workflow enabled directory schema as recited by claim 73,
14 further comprising a status monitoring content class for storing a status of an
15 object instance of the workflow content class.

16
17 77. A computer-readable medium comprising a workflow enabled
18 directory schema as recited in claim 73.

19
20 78. A computer comprising a computer-readable medium comprising a
21 workflow enabled directory schema as recited in claim 73.